# AMACRO 2024, Problem set #2

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Consider the same model as from the previous problem set:

$$C_t^{-\sigma} = \beta E_t \left( C_{t+1}^{-\sigma} \left[ \alpha Z_{t+1} K_{t+1}^{\alpha-1} + (1-\delta) \right] \right)$$
$$C_t + K_{t+1} = Z_t K_t^{\alpha} + (1-\delta) K_t$$
$$Z_t = (1 - \rho_z) + \rho_z Z_{t-1} + \epsilon_{z,t}$$

I. **Transformation in logarithms**

1. Specify the variables in *log*, so that irfs are in percentage terms:
   *two ways*:
   (a) specify variables in the FOCs as $exp(x)$, then $x = lnX$
   (b) specify variables in the FOCs in levels and then include auxiliary variables defining logs of variables

2. Then, define the initial conditions in the steady state blocks as logs

3. Given the calibration used in the previous problem set, generate impulse responses to a productivity shock

4. Simulate out variables by drawing shocks from a Normal distribution for 1000 periods, by using the "stoch-simul" Dynare command

II. **Generating Impulse responses and Simulations**

1. Create a Main.m file in Matlab, where you run the dynare file, and then define a vector of values for the two states (around their steady state values), and plot the policy functions of each variable

2. Then, create the matrices of the steady state representation of the model solution and compute impulse responses to the productivity shock by hand. Verify they check out with what Dynare produced.

3. Simulate out variables by drawing shocks from a Normal distribution for 1000 periods, by assuming that everything begins in steady state, so that the initial conditions are all

zeros (recall variables are deviations from steady states). Then, add the means, that in linear approximations are the steady state values. Plot the simulated data and comment them. Verify the moments of the simulated data check with what Dynare produced.

III. **Introduce non-linearity**

1. Introduce an equation for the value function in recursive form. Adjust variables accordingly

2. Solve the model in 2nd-order approximation

3. Evaluate the welfare in this economy when the size of the shock increases.